

Zero-Emission Delivery Vehicle Deployment

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Houston-Galveston Area Council
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Project ID:
ELT116



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Overview

Zero Emission Delivery Vehicle Deployment

Timeline

- Start date: October 1, 2012
- End date: January 30, 2019

Budget

- Total funding
 - DOE share: \$2,430,177
 - Contractor share: \$2,760,000
- FY17 Expenditure:
 - DOE Share: \$25,758
 - Contractor Share: \$0
- FY18 Expected Expenditure:
 - DOE share: \$40,000
 - Contractor share: \$0

Barriers

1. High cost of low volume orders for all-electric medium- and heavy-duty trucks
2. Uncertainty in production capabilities and timeline for all-electric trucks
3. Fleet acceptance of electric drive vehicle by showing reliability and matching trucks to the correct applications and routes

Partners

- Collaborators
 - Center for Transportation and the Environment
 - Fleet Partner – UPS
 - OEM Partner – Workhorse
- Project Lead
 - Houston-Galveston Area Council



Project Relevance

Primary Objective: Accelerate introduction and penetration of electric transportation technologies into the cargo transportation sector, specifically by deploying 18 prototype all-electric delivery vehicles

Barriers	Project Activities
High cost of vehicles	Provide grant funding to incentivize deployment and testing of medium/heavy-duty zero emission vehicles
Challenges to fleet acceptance related to lack of infrastructure and matching vehicles to routes and applications.	Provide funding for required infrastructure. Conduct pre-deployment data collection and analysis on vehicle performance to demonstrate suitability
Experimental vehicles	New technology can have less reliability than proven technologies. Grant funding and fleet expansion decreases carrier risks to accepting unproven technologies, allowing space for fleet and manufacturer to work through vehicle issues in an operational setting

Project Approach and Strategy

To be successful, the deployed technologies had to be:

- Available
- Cost effective
- Meet performance expectations

Therefore, remaining project activities include:

- Continue vehicle deployment, monitoring, data collection
- Develop performance and benefits analysis summary for project

Accomplishments & Progress

Project Outcomes for FY17:

- All project vehicles have been deployed since November 2016 after being subjected to on-site preparations and readiness tests.
- Next Steps:
 - Continuing to collect operational data from project vehicles. This will occur for a total of two years and be completed in November 2018.
 - Analyze operational data and report on demonstration data, final project outcomes, and lessons learned.

Milestones

Zero Emission Delivery Vehicle Deployment

Activity	Timeline	Status
Call for Projects <i>(for fleet partners with all-electric delivery vehicle OEM)</i>	5/2014 – 5/2016	Complete
Select Partners & Issue Notice to Proceed	6/2014 – 9/2016	Complete
Purchase & Manufacture of Vehicles	9/2014 – 7/2016	Complete
Delivery of Vehicles	10/2015 – 8/2016	Complete
Full Demonstration of All Vehicles	11/2016 – 11/2018	Ongoing

Accomplishments & Progress

Zero Emission Delivery Vehicles:

Workhorse E-100 Electric Delivery Van

- *Range: 80 to 90 miles*
- *Motor: 180 kW
1,106 ft-lbs torque*
- *Batteries: 120 kWh*
- *22 kW conductive
charging onsite*



Accomplishments & Progress

- These are prototype vehicles
- Has resulted in unanticipated and ongoing issues with certain components
- Main equipment issues
 - DC/DC Converters
 - Chargers
 - High Voltage Interlock
 - Other Mechanical Problems

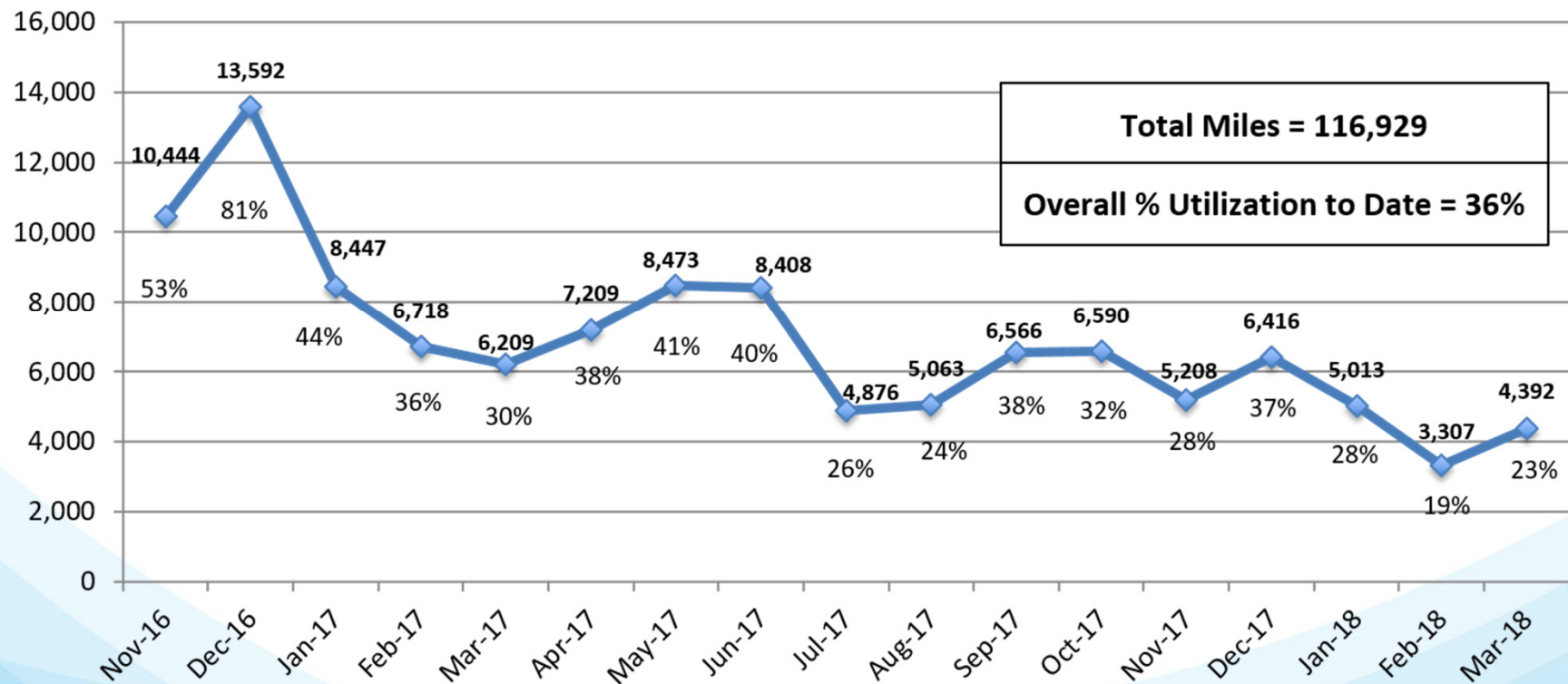
Accomplishments & Progress

- The originally installed DC/DC converters had an improper heat sink leading to overheating and part failure.
- Chargers are having similar issues and have had high failure rates.
- Workhorse is working to procure new equipment in both cases, but there are difficulties.
- Replacement isn't just swapping out parts. New parts can be significantly different. This results in significant re-engineering of the existing vehicle to accept the improved equipment

Accomplishments & Progress

Demonstration Vehicle Utilization: November 2016 – March 2018

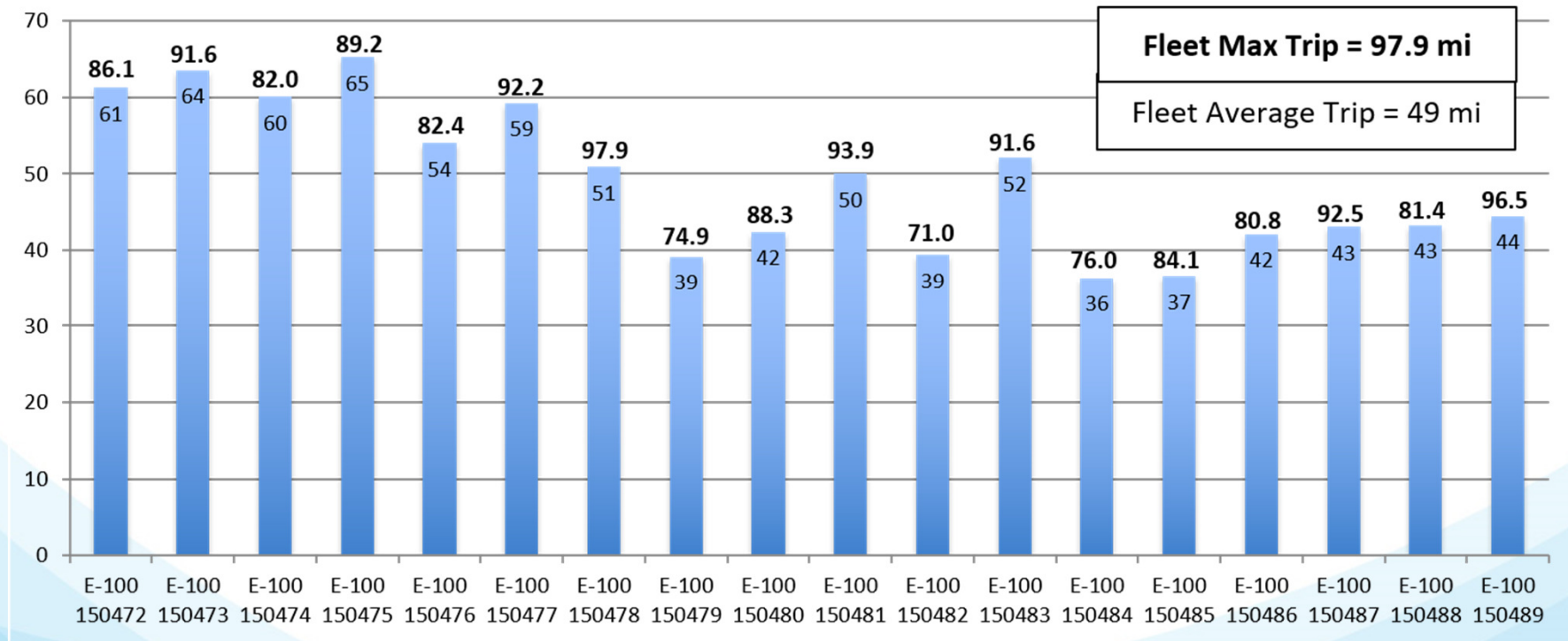
Total Electric Vehicle Fleet Miles by Month



Accomplishments & Progress

Demonstration Vehicle Utilization: November 2016 – March 2018

Maximum and Average Miles/Trip by Vehicle

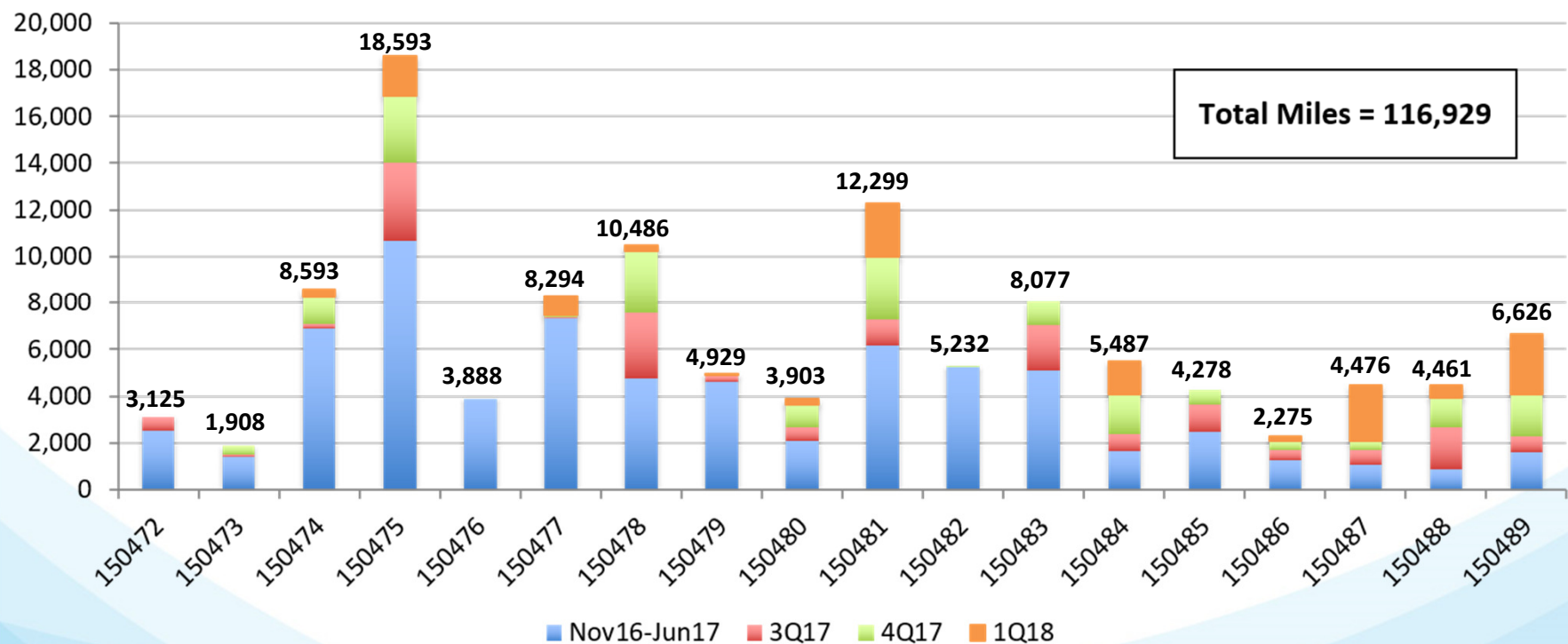


Accomplishments & Progress

Demonstration Vehicle Utilization: November 2016 – March 2018

Total Miles by Vehicle

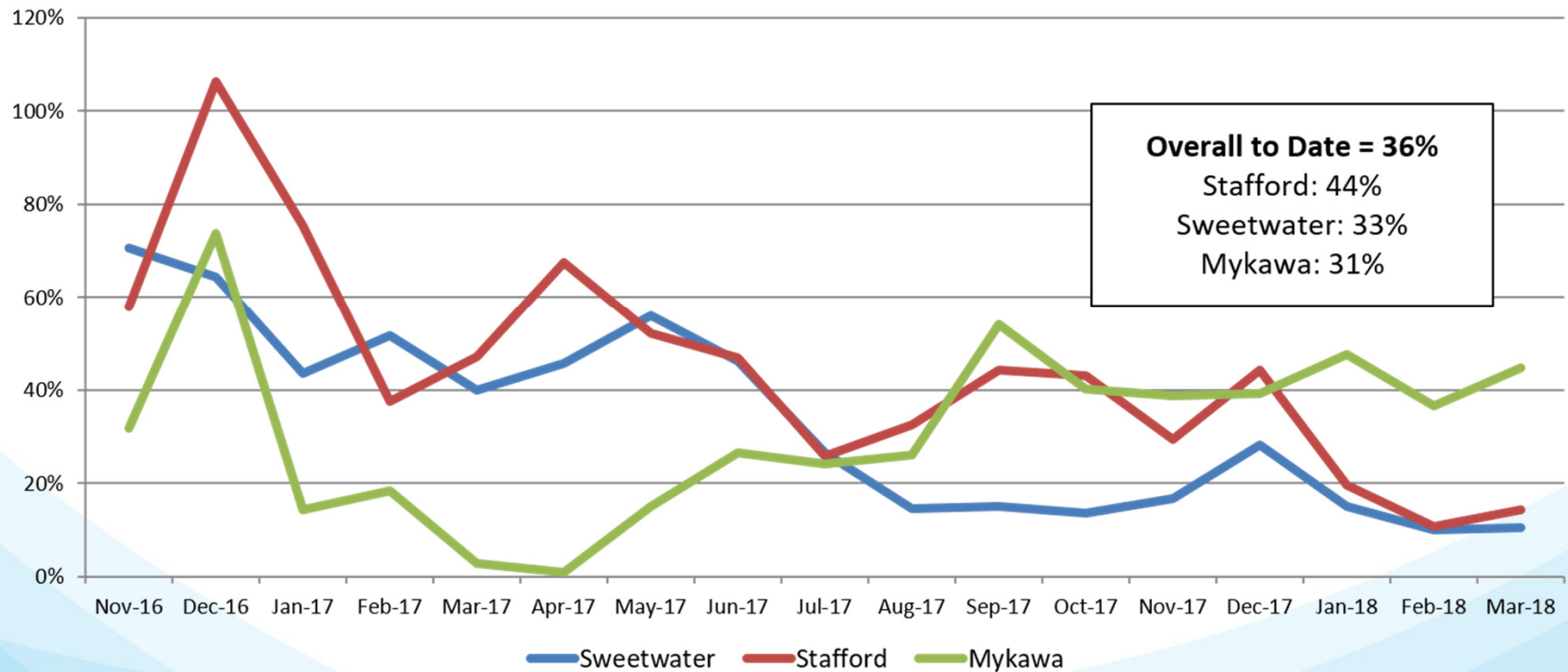
Total Miles = 116,929



Accomplishments & Progress

Demonstration Vehicle Utilization: November 2016 – March 2018

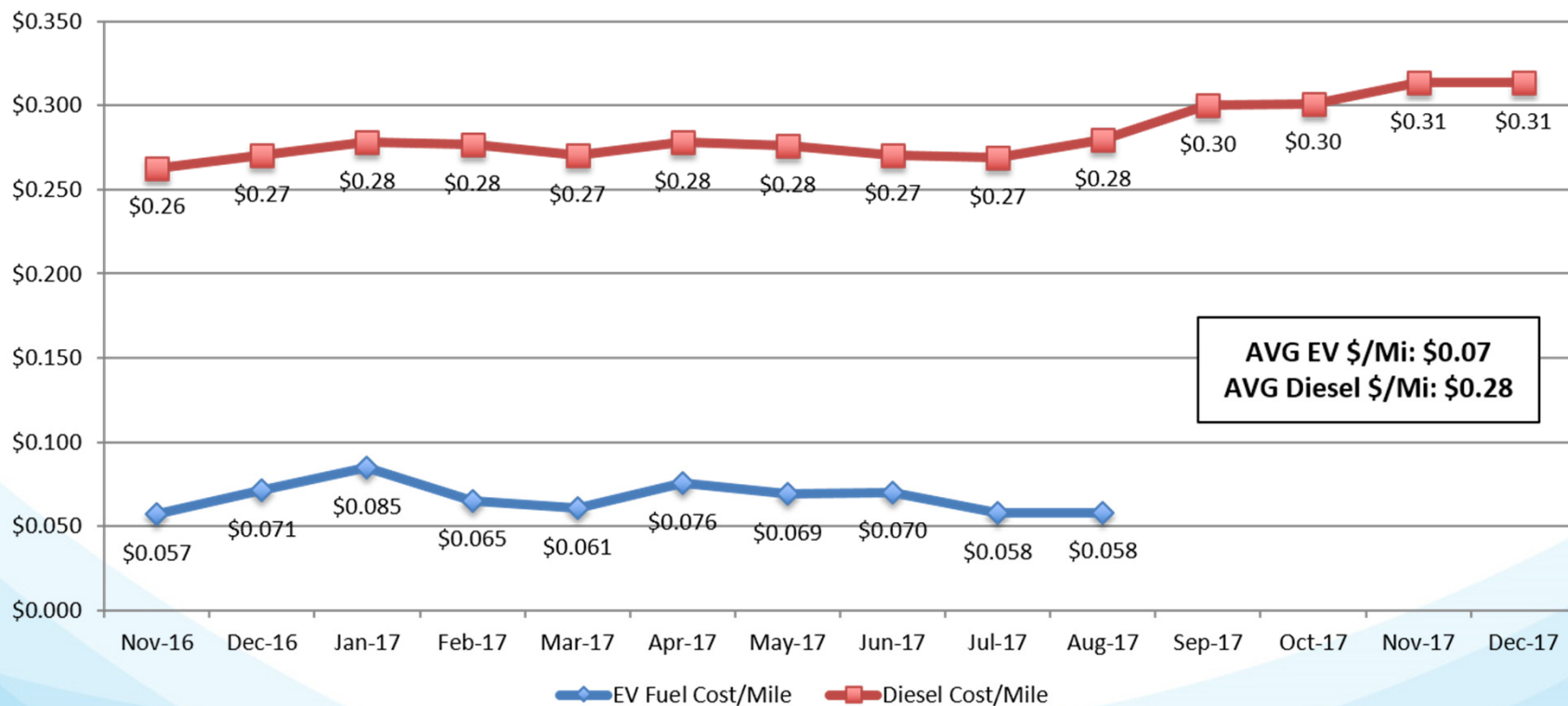
Utilization % by Facility



Accomplishments & Progress

Demonstration Vehicle Fuel Consumption: November 2016 – March 2018

Estimated Fuel Cost/Mile Comparison by Month

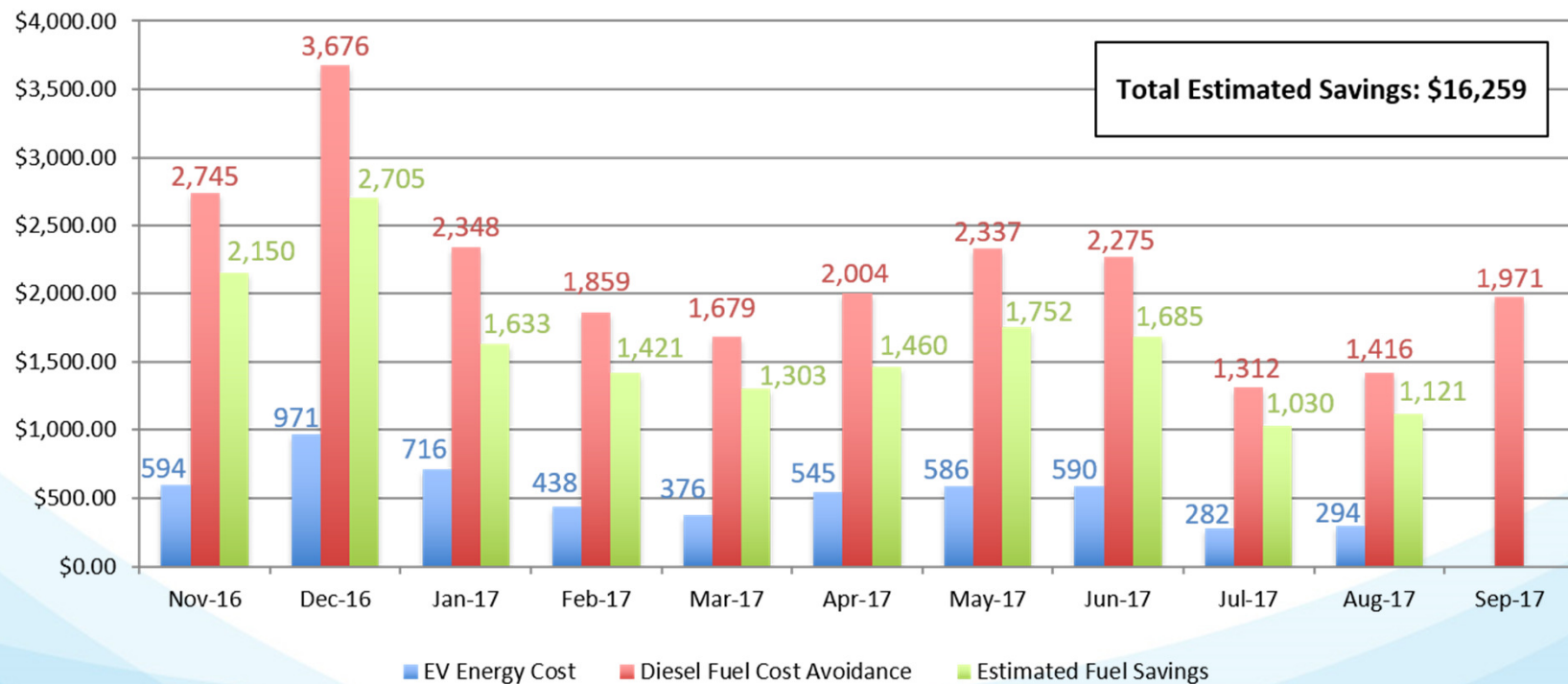


*Derived from UPS utility bills. These have been delayed since September 2017.

Accomplishments & Progress

Demonstration Vehicle Fuel Consumption: November 2016 – September 2017

Estimated Fuel Cost Savings by Month



Accomplishments & Progress

Demonstration Vehicle Environmental Benefits: Nov. 2016 – March 2018

- Greenhouse Gas Reductions: 201.2 tons
 - Equivalent to taking 21 UPS package off the road
 - Equivalent to carbon removed by 4,680 trees
 - If you include electric generation emissions, project still results in a reduction of 122.7 tons of GHGs
- Diesel Avoidance: 17,530 gallons
 - Resulted in 133 lbs of NOx reduction
 - Resulted in 15 lbs of VOC reduction

Response to Previous Years Comments

Comment from 2017 AMR	Response
A reviewer noted only a list of summary metrics for each vehicle was presented, which is inadequate for drawing any conclusions or comparisons to conventional vehicle use in the same application.	With additional demonstration time, we were able to provide additional metrics. We hope that these additional inclusions have provided sufficient material for the development of conclusions.
The reviewer suggested that the truck OEM does not seem to be incentivized to keep the EVs operational. Perhaps consider that as a financial milestone if you were to do a similar project in the future.	We tried to structure the project in a way that would be most flexible for the fleet partner and didn't consider taking OEM performance into account. For future projects, we hope to include more direct financial benefits for performance. We consider this a learning experience from this project.
It would have been good to have additional data analysis with respect to utilization of the trucks.	We worked to improve this through this presentation and hope that the analysis this year was sufficient.

Collaboration

- Contract Lead – Houston-Galveston Area Council
- ***Zero Emission Delivery Truck***
 - Project Administration & Technology Partner – Center for Transportation and the Environment
 - Fleet Partner – UPS
 - OEM Partner – Workhorse

Remaining Challenges, Barriers & Lessons Learned

- *Ensuring reliability of project technologies related to project vehicles*
 - Work to ensure that vehicles are meeting reliability needs to the greatest extent possible
 - Make sure that lessons learned from the demonstration are being rolled into future models to ensure improved outcomes

Remaining Challenges, Barriers & Lessons Learned

- ***EVs are still new technology***
 - There is a need to work with prospective buyers to help them understand vehicle capabilities and limitations and tailor solutions.
 - Education may help to decrease user uncertainty and increase faith in the technology.
- ***Prototype vehicles may not be as reliable as traditional ones.***
 - Problems might not be immediately apparent and may only show themselves over time.
 - Users need to use technology prudently. Do not schedule vehicles for mission critical periods.
- ***Be mindful of specific EV-related issues***
 - Like the vehicles, the internal EV equipment is also quickly developing. DC/DC converters and chargers have shown issues in these vehicles.
 - There is a need for standardization of these parts to ease replacement and upgrades.

Future Work

Next Steps for FY18:

- Continue two-year performance monitoring period for all 18 Workhorse electric vehicles
- Work with Workhorse and UPS when possible to increase utilization and ensure optimal performance for project vehicles

Summary

- H-GAC and project partners completed the delivery and deployment of 18 Workhorse manufactured, UPS delivery vehicles in the Houston region
- Data collection and analysis of these vehicles is ongoing
- There have been ongoing issues with some vehicle equipment resulting in ongoing low vehicles utilization. Feedback and concerns about reliability have resulted in some unexpected issues and even less utilization



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